

Rural Vulnerability in Serbia*

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Abstract

In the presence of risk and uncertainty, measures such as poverty rates are inadequate to analyze the well-being of poor households. The poor are not only concerned about the current low levels of their income or consumption, but also the likelihood of experiencing stressful declines in these levels in the future. Risks to livelihood are particularly important in rural areas where there is generally high dependence on agriculture and the environment. In this study, we analyze the nature, extent and causes of rural vulnerability in Serbia using panel national household data from the 2002 and 2003 Serbia Living Standard Surveys. Rural vulnerability is measured as a function of non-stochastic determinants of poverty as well as exposure to risk. While low levels of consumption (i.e., poverty) explain about 70 percent of vulnerability, we identify risk and uncertainty as crucial dimensions of rural life in accounting for the remaining 30 percent of household vulnerability. Households and regions with a greater share of their livelihood depending on agricultural activities are more at risk of vulnerability than those with a significantly higher share of their income coming from non-agricultural sources. Dependence on agricultural income is directly associated with higher aggregate risk, underscoring the agricultural sector's lopsided exposure to covariate shocks in general and the negative impact of the 2003 drought in particular. Rural vulnerability to poverty and risk is also strongly associated with asset ownership and access to markets to mobilize them in time of need.

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1. Introduction

The study is aimed at analyzing the nature, extent and causes of rural vulnerability in Serbia. While poverty and vulnerability are inextricably linked (Banerjee and Newman, 1994; Morduck, 1994; Kamanou and Morduck, 2002), the presence of risk and uncertainty—the fact that the level of future well-being is uncertain—distinguishes the concept of vulnerability from that of poverty. Results of worldwide consultations with the poor revealed that they regularly identify risk and uncertainty and their inability to effectively deal with them as crucial dimensions of their vulnerability (Narayan, et al., 2001; Kanbur and Squire, 1999; World Bank, 2001). Households are vulnerable to the risk of sudden (perhaps gradual) decline of their welfare positions to the extent they are unable to cope. As a result, there is a growing emphasis on a forward-looking concept of vulnerability in order to address the shortcoming characteristic of *ex post*, often times one-off, poverty measures (World Bank, 2001). There is a general consensus that in the presence of risk and uncertainty, the traditional measures of poverty are inadequate to analyze household welfare and multifaceted risk management strategies. In this study, using panel Serbia Living Standard Survey (SLS) data in 2002 and 2003, we measure rural vulnerability in Serbia as a function of non-stochastic determinants of poverty, exposure to risk, and households' ability to cope with shocks.

Background

For a majority of Serbia's population, the living standard at present is much lower than it was at the beginning of the transition from planned to market economy in the early 1990s, a result of ten years of political and economic adversity, internal conflict and international isolation. While this economic downturn affected all segments of the society, it has made conditions more sharply worsen particularly for the rural population and other disadvantaged groups such as internally displaced people (IDP) and refugees. Discussions with rural households suggest that the contemporary view of poverty in rural Serbia is not only as a situation of material deprivation, but also it is a demoralizing state of living that stems from comparing and contrasting the better past with the dire present and a not so bright future.

The Serbian economy averaged per capita growth rate of nearly 5 percent in the early 2000s (Table 1). Serbia implemented a highly effective stabilization program, which brought about important improvements in broader macroeconomic indicators including achieving single digit inflation, a stable exchange rate, and a considerable increase in foreign reserves. Substantial capital inflows from donors and other sources, and improvements in the management of public finances and financial policy also played an important role in establishing macroeconomic stability at the initial stage of the program. The combined effect of the macroeconomic stability and capital inflows has been a significant economic growth between 2000 and 2003.

Table 1. Key macroeconomic indicators (in percent, unless otherwise specified)

	2000	2001	2002	2003
Real GDP per capita growth	5.2	5.1	4.5	2.4
Agricultural growth	-13.0	17.4	-3.2	-7.0
Inflation, GDP deflator	75.0	89.8	24.1	16.3
Inflation, food prices	105.3	87.6	6.8	1.0
Agriculture, producers' price inflation	158.0	70.0	1.0	1.0
FDI (% of GDP)	0.3	1.6	3.3	7.1

Source: International Financial Statistics, Serbia Statistical Office, and World Development Report 2003.

However, the economic growth and macroeconomic stability have not been translated into significant poverty reduction, according to the 2002 and 2003 SLS.¹ Serbia wide, headcount poverty declined by only about 5 percent between 2002 and 2003 (Table 2). Urban poverty had declined from about 8.3 percent in 2002 to 7.1 percent in 2003, about 15 percent decrease. On the other hand, rural poverty, which was already higher than urban poverty by more than 87 percent in 2002, was further worsened by 6.4 percent in 2003. In 2003, the likelihood of poverty in rural areas is more twice that in urban areas in 2003. While the rural population makes up a little over 40 percent of the total Serbia's population, Serbia's poor residing in rural areas now account for close to three-fourths of the national poverty. Understanding the nature, extent and causes of rural vulnerability is thus a key to poverty and inequality reduction in the Serbian Republic.

Table 2. Despite decent economic growth, national poverty has stagnated between 2002 and 2003

	Serbia	Urban	Rural
2002	11.5	8.3	15.6
2003	10.9	7.1	16.6
% Change	-5.2	-14.5	6.4

Source: Serbia LSMS, 2002 and 2003; Statistical Office of Republic of Serbia. The poverty rates are based on per consumer unit consumption expenditure adjusted for regional price variations. The poverty line of 4487 and 4987 dinars were used for 2002 and 2003, respectively.

The Serbia Living Standard Survey (SLS) Data

Two major data sources are used: the 2002 and 2003 panel Surveys on the Living Standard of the Population of Serbia (SLS). The surveys were based on a two-stage stratified sample, with primary sample units being the census districts and secondary units being the households. The census districts are selected with probability, which is proportional to the number of households, so census districts with more households will be more likely to be selected. The surveys are representative of all six major regions and urban and rural areas in each region. The survey instrument includes a few modules relevant for rural poverty study, including demographic

¹ As the data are only a two year panel, the poverty dynamics presented here are just indicative of the trend between 2002 and 2003, and it is not intended to describe the overall trend of poverty in Serbia in the early 2000s.

characteristics, agriculture, consumption expenditures, healthcare, education, and social programs. They provide data on household spending, as well as other elements of living standard of population such as housing, durable goods consumption, agriculture and landholding, access to social services and others. The two year panel data contain observations on over 2540 sampled households from throughout Serbia. Of these observations, about 1120 of them are rural. The two year panel survey data are augmented with district level time-series rain fall and topography information to enable an in depth analysis of determinants of agricultural productivity, rural poverty and vulnerability in rural Serbia.

Rural Poverty Dynamics in Serbia

A close look at the level of rural poverty in Serbia in 2002 and 2003 shows a remarkable dynamics, even in a single year. Although overall increase in rural poverty appears small (see Table 2 above), a closer look at the households falling into or moving out of poverty and those remaining permanently poor reveals a more complex picture. While 53 percent of the poor in 2002 (about 8.3 percent of rural population) moved above the poverty line, about 10 percent of the non-poor in 2002 became poor in a span of one year (Table 3). Poverty persisted among 7.3 percent of the rural population (i.e., 47 percent of the poor in 2002), which may be explained by structural problems that prohibit income mobility to jump above the poverty threshold.

Table 3. There are significant movements in and out of poverty in rural Serbia

	Poor in 2003	Non-poor in 2003	Total
Poor in 2002	7.3	8.3	15.6
Non-poor in 2002	9.9	75.5	84.4
Total	16.2	83.8	100

Source: Serbian Living Standard Surveys (SLS) 2002 and 2003.

Several short- and long-term factors may have been responsible for observed increase in rural poverty and vulnerability. First, the drought of 2003 had led to declines in agricultural productivity, which directly affected rural areas. Agricultural production declined by 5.7% in 2003 due to unfavorable weather conditions. Second, the existing policy environment may have had an adverse and countercyclical effect on rural incomes. For instance, an appreciating real exchange rate and price controls may have kept agricultural product prices artificially low even during the drought year, thus protecting the purchasing power of net consumers of agricultural products (mostly urban) at the expense of net producers of agricultural products (mostly rural). Third, the recent enterprise restructuring may have also affected the employment opportunities in the manufacturing sectors, with direct and indirect negative impact on the rural population in an economy characterized by strong forward and backward linkages between farming and manufacturing. And finally, the lingering effects of the Kosovo conflict may have also aggravated rural deprivation due to influx of migrants, particularly in border regions.

2. Vulnerability—Conceptual Framework

Chambers (1983) eloquently expressed that poor people are not only concerned about the current low levels of income or consumption, but also the likelihood of experiencing stressful declines in these levels in the future. Vulnerability, the insecurity of well-being of the

individuals, households, or communities in the face of changing environment, can be considered as the net effect of three interrelated processes: non-stochastic determinants of poverty (e.g., household head education), exposure to risk (e.g., drought), and ability to cope with shocks (e.g., through insurance and credit markets). Thus in measuring vulnerability, not only current income or consumption of households should be taken into account but their assets and changes in assets over time in order to gain a deeper understanding of chronic poverty beyond the money-metric conceptualizations of poverty that have dominated the current poverty literature.

There are various approaches in the literature for measuring vulnerability to poverty, which differ in conceptualization and definition of vulnerability, in treatment of the state of world yielding non-poverty outcomes and the information base for their empirical application (e.g., panel versus cross-sectional data). Glewwe and Hall (1998) and Dercon and Krishnan (2000, 2003) define vulnerability as household's ability to smooth consumption, by looking at observed changes in consumption over time in response to shocks. According to their approach, if household consumption expenditures co-vary with income shocks, then one may infer that the household lacks the means to smooth or insure away these shocks, and therefore vulnerable. Christiansen and Boisvert (2000) define vulnerability as the probability now of having a shortfall in the future. They measure vulnerability as the probability of falling below a pre-determined poverty line, multiplied by a conditional probability-weighted function of a shortfall below this poverty line. According to this definition, taking FGT poverty measure with $\alpha = 0$ equates vulnerability to expected headcount poverty. But this is inadequate as it has the same shortcomings as headcount poverty measure in the way it treats household attitudes to risk. For $\alpha > 1$, the measure accounts for household's risk-aversion behavior such that households with a higher probability of large shortfalls become more vulnerable (Kamanou and Morduck, 2001). Even with $\alpha > 1$, the Christiansen and Boisvert approach has serious weakness as the use of the FGT vulnerability aversion implies increasing absolute risk aversion with increasing consumption below the poverty line, which is inconsistent with risk preferences of poor households.

A milestone contribution to measurement of vulnerability is by Elbers and Gunning (2003). They present a more elaborate measure of vulnerability based on structural model of household's consumption and saving behavior as an outcome of intertemporal optimization under uncertainty. A simulation-based vulnerability measure is then recursively estimated as a shortfall from the welfare attained if the household consumed permanently at the poverty line. Such an approach ensures that household's responses to shocks (both *ex ante* and *ex post*) are explicitly accounted for. This clearly is an improvement over vulnerability measures based on expected poverty such as that by Christiansen and Boisvert (2000) and regression-based methods such as the one by Glewwe and Hall (1998) that cannot adequately measure the impact of risk on household welfare. In the latter approaches household responses to shocks are not explicitly accounted for in estimations.

Elbers and Gunning (2003) illustrate their method by estimating Ramsey type model using panel data from Zimbabwe. A powerful implication of their approach is that vulnerability can change over time as a result of both growth and household's adjustment to shocks. Households can become chronically poor because of their responses to shocks may lower their consumption permanently. There is ample evidence in the literature that shocks and household responses to

them cause lower human capital formation and lower incomes. For example, studies in India have found that negative economic shocks caused households to withdraw children from schools (Jacoby and Skoufias, 1995). In agricultural and rural areas, the presence of high risks and limited ability to cope with it has been found to influence the choice of crops and technology (Morduck, 1995). Policies that reduce risk or improve household's ability to cope with risk, therefore, not only reduce volatility of household consumption, but may also reduce vulnerability. Elbers and Gunning (2003) is thus a major point of departure from most existing measures of vulnerability, which do not account for any behavioral responses to risk. However, their vulnerability measure is based on ad hoc basis since, as Thorbecke (2003) argues, they do not set up a threshold that is typically related to poverty line or expected poverty line (Thorbecke, 2003). This is unlike most other approaches of measuring vulnerability that typically use a poverty line as a reference point. Another difficulty is the assumption that a household knows the distribution of shocks and adjust its response on the basis of this knowledge. But if a household has an adequate knowledge of the shock-generating mechanism, it becomes less vulnerable anyway. Added disadvantage of the Elbers and Gunning (2003) is that, as is common with most stochastic models, their approach is quite data intensive. Not quite feasible in our case with only two year panel data.

Finally, Ligon and Schechter (2003) break down vulnerability into two components reflecting poverty and risk. They define vulnerability in utilitarian framework as the difference between household utility at poverty line and expected utility at a future date, explicitly accounting for household risk preferences through a choice of relevant utility function. Such framework explicitly accounts for the fact that decisions regarding consumption are interlinked to decisions regarding income generation and perceptions of risks. Because of its appeal and suitability to our data, we utilize a variant of Ligon and Schechter (2003) model to measure rural vulnerability in Serbia.

According to Ligon and Schechter (2003), vulnerability of household h is given by

$$V_h = U_h(z) - EU_h(C_h) \quad (1)$$

Where U_h is a concave function of expenditures and z is a certainty equivalent poverty line. A household is considered vulnerable if $V_h > 0$. The advantage of this measure is that it can be decomposed into what Ligon and Schechter call 'non-random part of vulnerability, which is poverty, and risk:

$$V_h = [U_h(z) - U_h(EC_h)] + [U_h(EC_h) - EU_h(C_h)] \quad (2)$$

Where EC_h is the expected value of household per capita consumption. Thus, vulnerability consist of welfare losses associated with both poverty and with risk and uncertainty. The risk component of vulnerability can be further decomposed nicely into aggregate and idiosyncratic risks:

$$U_h(EC_h) - EU_h(C_h) = [U_h(EC_h) - EU_h(E(C_h | X))] + [EU_h(E(C_h | X)) - EU_h(C_h)] \quad (3)$$

Where X is a vector of aggregate variables and $E(C_h|X)$ is the expected value of consumption, C_h , conditional on vector of aggregate variables X . Here the first term in the right hand side represents the aggregate risk facing the household, while the second accounts for idiosyncratic risk.

Rural Vulnerability in Serbia—Empirical Model

In this section we analyze rural vulnerability taking advantage of the panel structure in the Serbia SLS of 2002 and 2003. While the notion of vulnerability encompasses multiple dimensions, the focus of this study is on vulnerability to consumption poverty. We examine the impact of aggregate and household level variables such as the distribution of assets, access to physical and social goods and services and geographic factors on rural vulnerability. This study adopts the methodology developed by Ligon and Schechter (2003) to estimate the vulnerability of rural Serbians (see the empirical model in the next section).

Following the Ligon and Schechter (2003) framework presented above, we use a constant relative risk aversion (CRRA) utility function $U(C) = (C^{1-\theta})/(1-\theta)$ with a relative risk aversion factor, $\theta = 2$. Note that using equation (3) above, vulnerability is decomposed into poverty and risk components. Risk is further decomposed into aggregate risk, idiosyncratic risk and unexplained risk components. Furthermore, each components of vulnerability are regressed over the same set of explanatory variables as those used to estimate total vulnerability. . For the regressions, the two year averages of the explanatory variables (see below) are used since estimates of vulnerability and its components are the same for a given household at any given time.

Explanatory Variables and Descriptive Statistics

In line with the main objective of the paper and the conceptual model presented in above, an extensive list of explanatory variables are used to examine the relative role of several individual, household, and community variables on rural household welfare. Household level variables included are demographic and educational variables, labor market participation and health status, main sources of income, physical and financial asset holdings, and household perception of its economic situation. Population age statistics from the 2002 Population census, regional consumer prices, local wages, and provincial dummies are used to capture regional heterogeneity and other factors beyond the control of individuals and households. These variables are commonly considered as determinants of household welfare in the literature.

Household level wage is measured by average wage paid per month per wage earning adult at the community level², not by wage rates derived at individual level. Community-level average wages provide a better description of prevailing labor market conditions than individual-level wages,

² Communities are defined as primary sampling units (PSUs) within a district as provided in the household survey design. As PSUs are levels at which random samples of households are drawn for the surveys, community level averages are assumed as good representatives of prevailing labor market conditions in their communities.

and they are based on wages reported by individuals who actually work. Furthermore, being community-level averages, they are less prone to endogeneity problems. Common determinants that figure prominently in household consumption empirical work, such as age and sex composition and maximum educational attainment of the household are among the explanatory variables. We included a measure of average age of the household to capture the impact of aging on rural welfare. We also included a few household level shock variables such as incidence of poor health, household's perception of financial hardships, participation in unstable and seasonal job markets, and dependence ratio (defined as the number of children ages below 15 and retired and elderly members per working age adults) to capture risk and uncertainty.

The covariates we use in our estimation include household demographic variables such as household size, household head sex, average household age, dependence ratio; household educational level variables such as a share of uneducated adults and a series dummies indicating whether maximum educational level is primary, secondary or higher; household occupational and health variables such as whether household head is unemployed or retired, number of household members employed in informal sector and seasonal jobs, whether household holds additional job, incidence of poor health in the household; household asset ownership variables such as whether a household is land owner or not, value of household durable assets, value of household's agricultural tools and machinery, and value of livestock ownership and production; household perception of its financial situation; share of agricultural income; regional and community variables such as indicators of East Serbia and South-east Serbia, the price of consumer goods, local wage rates, and number of children and elderly per working age adult at the district level.

Annex 1 presents descriptive statistics of selected variables. Rural areas tend to have a larger family size, but are comprised of a more aging population. Educational levels are generally lower in rural areas, with higher dependence ratio, with a larger fraction of household members engaged in informal sector and seasonal jobs. Access to social services, as measured by distance to various such services, indicates that rural households have to travel nearly twice the distance compared to their urban counterparts to health centers, hospitals, schools and other vital community service centers. Both chronic and acute sicknesses appear more rampant in rural areas, with nearly 1 out of 2 family members experiencing poor health.

About 60 percent of rural households describe their financial situation as bad. It is interesting to note that while about 60 percent of both urban and rural households considered their family situation bad in 2002, there is considerable difference in urban and rural perception of their financial situation in 2003. While only less than 50 percent of urban households in 2003 identify their finances as dire, the rural perception has not improved during the same period. Per adult equivalent consumption expenditure is a good deal higher in urban than in rural areas and the trend continued so in 2003, perhaps widening urban-rural gap to a great extent.

In terms of income sources, agricultural income is nearly as equally important as wage income in rural areas. In urban areas, compared to wage income, agricultural income is negligible. While nearly 85 percent of rural households are engaged in some kind of agricultural activity, the level of involvement of urban households in agriculture is less than 20 percent. Rural households generate significant proportion of their consumption from own production in crop and livestock.

However, these sources of consumption such as own consumption of livestock has decreased following the drought (see Annex 1).

Results

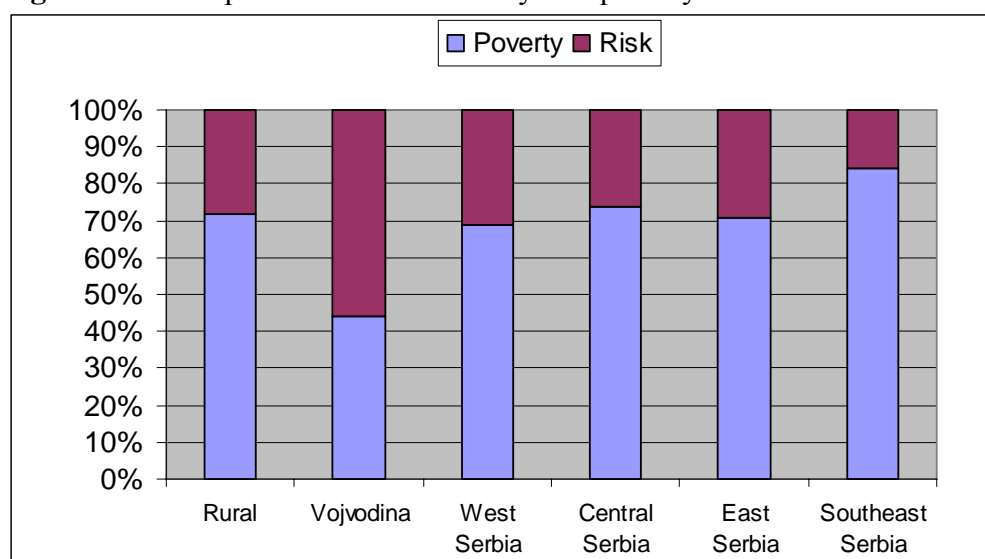
Vulnerability is decomposed into poverty and risk components (see Annex 2 and Figure 1). About 23.6 percent of the rural Serbians are vulnerable. It is interesting to compare the relative contribution of poverty and risk to overall vulnerability. With headcount poverty rate of 16.2 percent in rural areas according to the 2003 household survey data, poverty is thus the major contributor of rural vulnerability in Serbia. Poverty accounts for over 70 percent of rural vulnerability. The findings contrast to that of Ligon and Schechter (2003) for Bulgaria that show poverty only accounting for about 53 percent of national vulnerability.

Close to 30 percent of the vulnerability is attributable to risk. Columns 3, 4 and 5 on Annex 2 show the various components of risk and their determinants. Since risk explains a non-trivial 30 percent of the rural vulnerability to poverty, the fact that rural poverty has increased in 2003 suggests a disproportionate exposure of rural areas to risk. This arises from several sources. First, most rural households in Serbia depend predominantly on agriculture for their livelihood. The shock to agriculture from the drought of 2003 led to a decline in agricultural output and incomes, and an increase in poverty. Second, land and rural credit markets are imperfect, with general lack of access to credit, high risk, and lack of marketable titles to land. Third, the current policy environment may have had an adverse and countercyclical effect on rural incomes. And finally, the recent enterprise restructuring may have also affected the employment opportunities in the manufacturing sectors, with direct and indirect negative impact on rural poverty. Public policies that help create better access to markets, diversification of income to non-agricultural sources, and greater ownership of assets will help reduce rural poverty and vulnerability.

Correlates of Vulnerability and Poverty

The regression results presented in Annex 2 show the various non-stochastic determinants of poverty and vulnerability such as household demographic and educational, occupational and health, physical and financial assets ownership and regional characteristics variables. One of the most striking results of this exercise is that factors determining vulnerability and poverty are quite similar. For rural Serbians, poverty and vulnerability are thus inextricably linked. The characteristics of those who are observed to be poor are strikingly similar to the characteristics of those who are estimated to be vulnerable, whether they are currently poor or not. This finding is in accord with those of Kamanou and Morduck (2002) in Cote d'Ivoire and others such as Banerjee and Newman (1994) and Morduck (1994). Therefore, interventions that aim to reduce the level of poverty in rural Serbia would also contribute to reduction in vulnerability.

Figure 1. Decomposition of vulnerability into poverty and risk in rural Serbia



Source: Author's calculations based on Serbia SLS 2002 and 2003.

High level of human capital such as education decreases vulnerability and poverty. Available evidence related to education elsewhere generally supports this finding (see, for instance, Adam and Jane (1995) for Pakistan; and Campa and Webb (1999) for Peru). Households with maximum education higher than secondary face significantly lower vulnerability than those with lower educational attainment. Jalan and Ravallion (1999) and (2000), for Pakistan and China, respectively, find similar evidence that higher level of education is what that matters. Our findings also imply that household demographic composition matters: households with bigger and more elderly members are more vulnerable and are more likely to be in poverty. All things being equal, increased household size is found to place extra burden on a household's asset/resource base and positively correlated with vulnerability and poverty. McCulloch and Baulch (2000), Jalan and Ravallion (1999 and 2001), and Aliber (2001) bring similar evidence from Pakistan, rural China and South Africa, respectively.

With regard to occupational variables, interestingly employment in the informal sector leads to less vulnerability and poverty, as does the number of household gainfully employed. On the other hand, households with greater dependence on agricultural income are at a significant disadvantage of vulnerability and poverty. Location is also an important correlate of vulnerability. Controlling for other factors, rural household residing in east and southeast Serbia are 22 and 13 percent, respectively, more vulnerable than those living in other parts of rural Serbia.

One of the most critical determinants of rural vulnerability and poverty is household durable asset ownership. Families with higher value of durable assets are significantly less vulnerable. Assets determine not only future income potential, but also the possibility of bouncing back from crisis situation as they affect household responses to shocks and their ability to cope with vulnerability. Studies elsewhere show that higher vulnerability may reflect low levels of asset holdings or persistently low returns on assets and (Gaiha and Deolaiker, 1993; Jalan and

Ravallion, 1999, 2001; Mehta and Shah, 2001). This study brings further evidence on the criticality of maintaining strong asset base to reduce poverty and vulnerability.

Public policy can play a better role in smooth functioning of safety nets through supporting accumulation or preventing loss of human and physical assets more so than via direct transfers. The accumulation and mobilization of assets, which are vital in mitigating risk, is largely predicated on the development of and access to market and market institutions. It is important to stress that not only the values of assets that matter for vulnerability, but also how they can be mobilized in time of need and the ease with which they can be transformed into outcomes, such as health, education and consumption. A highly significant coefficient on vulnerability and poverty of the regional price index variable strengthens the role of development and access to markets for inputs and outputs.

Aggregate variables such as geographic location and topography, drought and access to communications services are significantly correlated with household vulnerability and poverty. Households in southeast Serbia are at a significant disadvantage of vulnerability than their counterparts in other provinces. Areas with mountainous topography appear more vulnerable, possibility suggesting their inaccessibility to vital physical and social infrastructure. Areas with poor access to communication infrastructure such as road are more vulnerable. Another important dimension of vulnerability in rural Serbia is due to weather shocks. The drought of 2003 had led to increased poverty and vulnerability as it had significantly depressed agricultural production. Rainfall variability and its deviations from the long-run normal are associated with increased vulnerability.

Correlates of Aggregate and Idiosyncratic Risks

Columns 3, 4 and 5 on Annex 2 show the various components of risk and their determinants. Although most factors affecting poverty appear to have similar effect on risk, there are a few important and interesting differences. For instance, employment in the informal sector does not play a significant role in risk mitigation as does in poverty reduction. On the other hand, households with retired head face significantly low idiosyncratic risk despite no significant effect on poverty of household head retirement. Also taking on additional work carries a significantly negative sign on idiosyncratic risk, but has no statistically significant effect on poverty. Larger share of agricultural income is directly associated with higher aggregate risk, underscoring agricultural sector's exposure to covariate shocks such as the drought of 2003, which affected most of Serbia. Livestock holding, on the other hand, lessens exposure to idiosyncratic shock and has no impact on aggregate risk. As far as the regional variables are concerned, east and southeast Serbia face greater exposure to aggregate risk than other provinces, but there is significant geographic differentiation with regard to idiosyncratic risk as would be expected.

Table 4 presents correlation coefficients among the various vulnerability components. High poverty significantly correlated with all components of risk, the magnitude of correlation is much higher with aggregate risk. Aggregate risk is significantly correlated with idiosyncratic and unexplained risks. However, there is no significant association between idiosyncratic and unexplained risks. The last two sentences suggest that unexplained risk, which is the second

most important contributor to household vulnerability, is due to unobserved factors having greater association with aggregate risk rather than idiosyncratic risk.

Table 4. Correlations among components of vulnerability

	Poverty	Aggregate Risk	Idiosyncratic risk	Unexplained risk
Poverty	1.0000	0.9816***	0.2444***	0.2431***
Aggregate Risk	0.9816***	1.0000	0.2427***	0.2359***
Idiosyncratic risk	0.2444***	0.2427***	1.0000	0.0398
Unexplained risk	0.2431***	0.2359***	0.0398	1.0000

Source: Author's calculations based on Serbia SLS 2002 and 2003.

Geographic Heterogeneity in Rural Vulnerability

Table 5 presents vulnerability and its components by region. Southeast Serbia is the most vulnerable, followed by east Serbia. Over 43 percent of rural residents in Southeast Serbia are vulnerable compared only about 11 percent in Vojvodina. Thus vulnerability in Southeast Serbia is almost fourfold compared to Vojvodina. Another interesting observation from Table 5 is that the contribution of poverty to vulnerability increases with the level of vulnerability. For example, poverty contributes only 44 percent of vulnerability in Vojvodina, while it accounts for over 84 percent of the vulnerability in Southeast Serbia. While further research is needed to explain more fully the regional disparities in vulnerability, an important policy implication of the current finding is that appropriately targeted interventions on the basis of the degree of poverty would have greater impact for reducing vulnerability.

Table 5. Rural vulnerability, poverty and risk across regions in Serbia

	Vulnerability	Poverty	Poverty contribution to vulnerability (%)	Risk	Risk contribution to vulnerability (%)
Vojvodina	0.113	0.0498	44.1	0.0632	55.9
West Serbia	0.1973	0.1362	69.0	0.061	30.9
Central Serbia	0.2118	0.1563	73.8	0.0554	26.2
East Serbia	0.261	0.1859	71.2	0.0751	28.8
Southeast Serbia	0.4316	0.3639	84.3	0.0677	15.7
Total	0.2282	0.1648	72.2	0.0634	27.8

Source: Author's calculations based on Serbia SLS 2002 and 2003.

Decomposition of risk into its aggregate, idiosyncratic and unexplained components suggests that aggregate shocks are the largest contributors to risk and uncertainty in rural Serbia (Table 6). The drought of 2003 and its sharply negative impact on agricultural production was the main

reason for apparently high aggregate risk. However, note that regional decomposition of risk does not show significant variation in the magnitude of risk across regions.

Table 6. Decomposition of risk into aggregate and idiosyncratic risk components

	Risk	Aggregate risk	Idiosyncratic risk	Unexplained risk
Vojvodina	0.0632	0.0271	0.0141	0.0220
West Serbia	0.061	0.0281	0.0104	0.0226
Central Serbia	0.0554	0.0253	0.0103	0.0198
East Serbia	0.0751	0.0341	0.0126	0.0284
Southeast Serbia	0.0677	0.031	0.0121	0.0247
Total	0.0634	0.0285	0.0121	0.0229

Source: Author's calculations based on Serbia SLS 2002 and 2003.

Conclusions

This paper dealt with rural vulnerability in Serbia with the notion that the well-being of poor households depends not only on households' current consumption or expenditures, but also on risk and uncertainty about their future welfare state. Accordingly, rural vulnerability in rural Serbia are estimated and decomposed into poverty and risk. While we find that poverty is the major contributor of rural vulnerability in Serbia, risk also contributed to rural households' perceived vulnerability. The fact that poverty accounts for such a high share of the vulnerability suggests that the characteristics of those who are observed to be poor are strikingly similar to the characteristics of those who are estimated to be vulnerable, whether they are currently poor or not.

Risk contributes a non-trivial 30 percent of household vulnerability in rural Serbia. Households and regions with greater share of their livelihood sources depending on agricultural activities are more at risk of vulnerability and poverty than those with significantly higher share coming from non-agricultural sources. Larger share of agricultural income is directly associated with higher aggregate risk, underscoring agricultural sector's exposure to covariate shocks such as drought. Preoccupation with risk and uncertainty may negatively affect growth and deter profitable investments from occurring (e.g., Collier and Patillo, 1997). A clear evidence of risk in rural Serbia suggests that the effectiveness of government programs aimed at poverty reduction should not only be assessed under the assumption of normal circumstances, but also with due regard for the possibility of risk and uncertainty. In order to address vulnerability, poverty reduction programs need to be augmented with policies dealing with risk and fluctuations in welfare.

High level of human capital such as educational level of household heads significantly decreases household vulnerability and poverty. Households with a member having higher than secondary face significantly lower vulnerability than those with lower educational attainment. Household demographic composition also matters: households with bigger and more elderly members are more vulnerable and are more likely to be in poverty. Aging population and reduced pool of active workers and the opportunity to generate income, compounded with low educational

attainment, significantly worsen rural poverty in Serbia. Employment in the informal sector leads to less vulnerability and poverty, as does the number of household gainfully employed.

Rural poverty and vulnerability is strongly associated with asset ownership and access to markets to mobilize them in time of need. Families with higher value of durable assets are significantly less vulnerable. Assets determine not only future income potential, but also the possibility of bouncing back from crisis situation as they affect household responses to shocks and their ability to cope with vulnerability. Increased level of vulnerability may reflect low levels of asset holdings or persistently low returns on assets. Public policy can play a significantly more important role in smooth functioning of safety nets through supporting accumulation or preventing loss of human and physical assets than via direct public transfers. Public policies that help build assets and create environment for their mobilization would be more effective to ensuring long-term rural economic growth and beef up their risk management and coping capabilities. The accumulation and mobilization of assets, which are vital in mitigating risk, is largely predicated on the development of and access to market and market institutions. It is important to stress that not only the values of assets that matter for vulnerability, but also how they can be mobilized in time of need and the ease with which they can be transformed into outcomes, such as health, education and consumption.

Aggregate variables such as geographic location and topography, drought and access to communications services are significantly correlated with household vulnerability and poverty. Over 43 percent of rural residents in Southeast Serbia are vulnerable compared only about 11 percent in Vojvodina. Thus vulnerability in Southeast Serbia is almost fourfold compared to Vojvodina. The contribution of poverty to vulnerability increases with the level of vulnerability. For example, poverty contributes only 44 percent of vulnerability in Vojvodina, while it accounts for over 84 percent of the vulnerability in Southeast Serbia. An important policy implication of this finding is that appropriately targeted interventions on the basis of the degree of poverty would have greater impact on vulnerability.

Finally, vulnerability in rural Serbia is strongly associated with weather shocks and topography. The drought of 2003 had led to increased poverty and vulnerability as it had significantly depressed agricultural production. Rainfall variability and its deviations from the long-run normal are associated with increased vulnerability. Areas with mountainous topography appear more vulnerable, possibility suggesting their inaccessibility to vital physical and social infrastructure. This reinforces the observation that areas with poor access to communication infrastructure such as road are more vulnerable.

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Annex 1
Descriptive Statistics

	2002		2003	
	Urban	Rural	Urban	Rural
Household size	3.01	3.30	3.00	3.20
Share of children (below 15)	0.11	0.11	0.11	0.09
Share of ages between 16 and 60	0.58	0.49	0.57	0.48
Share of elderly (age 61 and above)	0.30	0.40	0.32	0.42
Average household age	45.3	48.9	46.5	50.8
Household head sex	0.27	0.19	0.27	0.21
Head has less than primary education	0.12	0.38	0.11	0.39
Household head is employed	0.42	0.44	0.42	0.38
Dependence ratio	0.44	0.51	0.44	0.50
Number of adults with no education	0.24	0.84	0.23	0.50
Maximum education is primary or below	0.18	0.49	0.17	0.48
Number employed in informal sector	0.05	0.25	0.07	0.21
Number employed in seasonal jobs	0.03	0.26	0.02	0.18
Number employed in agriculture	0.05	0.43	0.05	0.38
Distance to health center	2.10	10.87	2.10	10.87
Distance to hospital	7.69	20.41	7.69	20.41
Distance to pharmacy	1.36	7.93	1.36	7.93
Distance to community office	3.30	13.53	3.30	13.53
Distance to secondary school	3.01	14.45	3.01	14.45
Sewerage service	0.78	0.28	0.80	0.34
Household owns land	0.13	0.68	0.13	0.68
Landholding size (in ars)	200	581	270	448
Household owns livestock	0.14	0.76	0.13	0.75
Number of chronically ill	0.80	0.90	0.80	0.86
Number with acute disease	0.65	0.77	0.48	0.53
Financial situation perceived as bad	0.60	0.59	0.48	0.57
Financial situation perceived as good	0.10	0.08	0.15	0.08
Amortized value of durables	195	154	281	181
Durable goods income	836	361	1047	383
Total agricultural income	247	2216	269	2255
Own produced food value	268	1690	211	1533
Value of durables	874	681	550	377
Own consumption of livestock	21	170	12	72
Value of livestock	38	731	22	346
Value of agricultural tools	53	913	31	498

Source: Author's calculation based on SLS 2002 and 2003.

Annex 2
Determinants of vulnerability in rural Serbia

Average value	Vulnerability = 0.2282 [0.208, 0.249]	Poverty = 0.1648 [0.148, 0.183]	Risk = .06343 [0.0558, 0.071]	Idiosyncratic risk = 0.0121 [.00893, .0157]	Aggregate risk = 0.0457 [.0351, .0616]
<i>Household demographic and educational variables</i>					
Household size	0.357 (7.3)***	0.333 (7.1)***	0.024 (3.6)***	0.005 (2.3)**	0.001 (7.4)***
Household head sex	0.003 (0.1)	-0.009 (0.3)	0.011 (2.3)**	0.001 (0.4)	-0.000 (0.2)
Average household age	0.271 (5.2)***	0.251 (5.0)***	0.020 (2.7)***	0.006 (3.0)***	0.001 (5.7)***
Dependence ratio	-0.027 (1.0)	-0.024 (0.9)	-0.004 (1.0)	-0.002 (1.4)	-0.000 (0.6)
Share of adults with no education	0.110 (1.7)*	0.117 (1.9)*	-0.007 (0.7)	-0.002 (0.6)	0.000 (1.8)*
Maximum educational level is primary	0.001 (0.0)	0.004 (0.1)	-0.003 (0.3)	0.000 (0.2)	0.000 (0.2)
Maximum educational level is secondary	-0.053 (0.7)	-0.042 (0.6)	-0.011 (1.1)	-0.002 (0.8)	-0.000 (0.4)
Maximum educational level is higher than secondary	-0.133 (1.7)*	-0.109 (1.4)	-0.024 (2.2)**	-0.006 (2.2)**	-0.000 (1.6)
<i>Household occupational and health variables</i>					
Household head is unemployed	0.055 (1.0)	0.054 (1.0)	0.001 (0.2)	-0.004 (1.5)	0.000 (1.3)
Household head is retired	-0.042 (1.3)	-0.045 (1.4)	0.002 (0.5)	-0.004 (2.7)***	-0.000 (1.1)
Number employed in informal sector	-0.033 (1.1)	-0.027 (1.0)	-0.006 (1.2)	-0.001 (0.6)	-0.000 (0.7)
Number employed in seasonal jobs	0.025 (0.8)	0.021 (0.7)	0.004 (0.7)	0.001 (0.5)	0.000 (0.7)
Number employed per capita	-0.132 (2.4)**	-0.123 (2.3)**	-0.009 (1.2)	-0.006 (2.2)**	-0.000 (2.3)**
Additional work	-0.036 (0.8)	-0.031 (0.8)	-0.006 (1.1)	-0.004 (2.8)***	-0.000 (0.7)
Household has incidence of poor health	-0.009 (0.6)	-0.006 (0.4)	-0.003 (1.3)	-0.001 (2.2)**	-0.000 (0.7)
<i>Household asset ownership variables</i>					
Household is land owner	0.002 (0.1)	0.001 (0.0)	0.001 (0.2)	0.001 (0.6)	-0.000 (0.7)
Value of household durable assets	-0.177 (14.3)***	-0.171 (14.3)***	-0.007 (4.4)***	-0.001 (2.8)***	-0.001 (15.2)***
Value of household's agricultural tools and machinery	-0.004 (1.1)	-0.004 (1.2)	0.000 (0.8)	0.000 (0.8)	-0.000 (1.4)
Value of livestock ownership and production	-0.017 (2.7)***	-0.015 (2.5)**	-0.002 (2.4)**	-0.001 (3.1)***	-0.000 (1.8)*
Share of agricultural income	0.077	0.072	0.005	0.001	0.000

	(2.9)***	(2.9)***	(1.4)	(1.0)	(2.9)***
Household financial situation perceived as bad	-0.055	-0.074	0.019	-0.000	-0.000
	(0.7)	(0.9)	(1.3)	(0.1)	(1.0)
Receipt of public transfers	-0.000	-0.000	-0.000	0.000	-0.000
	(0.5)	(0.4)	(0.4)	(0.8)	(0.0)
<i>Regional variables</i>					
East Serbia	-0.092	-0.097	0.005	0.002	-0.000
	(0.7)	(0.8)	(0.3)	(0.3)	(0.1)
South-east Serbia	0.208	0.208	0.000	-0.003	0.001
	(2.4)**	(2.5)**	(0.0)	(0.6)	(1.7)*
Proportion of children per working age adult— district	-1.078	-1.075	-0.003	0.046	-0.003
	(1.3)	(1.4)	(0.0)	(1.4)	(1.0)
Proportion of elderly per working age adult— district	0.500	0.429	0.071	-0.004	0.001
	(1.5)	(1.3)	(1.4)	(0.3)	(1.1)
Regional consumer price index	5.444	5.582	-0.138	-0.076	0.012
	(1.2)	(1.3)	(0.2)	(0.4)	(0.8)
Average monthly wage rate	-0.027	-0.026	-0.001	0.001	-0.000
	(1.1)	(1.1)	(0.3)	(1.5)	(1.4)
Roads (KM per capita)	-7.808	-6.517	-1.291	-0.646	-0.029
	(0.8)	(0.7)	(1.0)	(1.3)	(0.9)
Altitude above sea level	0.093	0.093	0.000	0.001	0.000
	(2.2)**	(2.3)**	(0.1)	(0.4)	(2.5)**
Rainfall percent deviations from normal	0.388	0.335	0.052	0.012	0.014
	(2.1)**	(1.8)*	(1.8)*	(1.1)	(2.1)**
Average rainfall for main cropping season, 2003	0.302	0.277	0.026	0.002	0.013
	(3.9)***	(3.5)***	(2.0)*	(0.6)	(3.0)***
Incidence of flooding	0.046	0.049	-0.003	-0.002	0.000
	(1.3)	(1.4)	(0.7)	(1.4)	(1.5)
Topography is mountainous	-0.219	-0.199	-0.020	-0.001	-0.001
	(2.1)**	(1.9)*	(1.2)	(0.2)	(1.8)*
Constant	-8.493	-8.295	-0.197	-0.011	-0.018
	(2.2)**	(2.2)**	(0.3)	(0.1)	(1.3)
Number of observations	1119	1119	1119	1119	1119
R-squared	0.5	0.5	0.1	0.1	0.5

Robust t statistics in parentheses and those in brackets are 90% confidence intervals.

*significant at 10%; ** significant at 5%; *** significant at 1%.